

THURSDAY, NOVEMBER 8, 1917.

UNIVERSITIES AND THE SUPPLY OF
RESEARCH WORKERS.

ONE of the most important matters to which the Department of Scientific and Industrial Research has to give close attention is the supply of research workers by our universities and colleges. Military necessity has reduced the number—already small—of students being trained in research methods at these institutions; and an inquiry shows that the output of such students must be greatly increased after the war if sufficient men are to be available to widen the foundations of our staple industries by the application of scientific knowledge. People are accustomed to think of universities as educational institutions only, whereas the essential standard of value, and the measure of their greatness, is the worth of their contributions to the growth of knowledge.

This principle was set forth very decidedly in the report of the Duke of Devonshire's Royal Commission on Scientific Instruction and the Advancement of Science more than forty years ago.

"On no point," said the Commissioners, "are the witnesses whom we have examined more united than they are in the expression of the feeling that it is the primary duty of the universities to assist in the advancement of learning and science, and not to be content with the position of merely educational bodies. We entirely concur with the impression thus conveyed to us by the evidence, and we are of opinion that the subject is one to which it is impossible to call attention too strongly. We think that if the universities should fail to recognise the duty of promoting original research, they would be in danger of ceasing to be centres of intellectual activity, and a means of advancing science would be lost sight of which, in this country, could not easily be supplied in any other way."

At the time when these words were written scientific research was all but dead in England; and so far as the advancement of knowledge was concerned we occupied the position of a third- or fourth-rate Power. Scientific men were convinced that action was urgently needed in order to promote the future development of our national industries, but neither the State nor the old universities to which the appeal was made took any steps to remedy the existing condition of things. The result is that, whereas we should have had hundreds of research workers trained in university institutions and making their influence felt afterwards in industrial works for a couple of generations, their numbers have had to be counted in tens.

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The State began to accept its responsibility for providing facilities for university education and research when in 1889 the House of Commons decided to recognise university colleges as national institutions by voting 15,000*l.* for distribution among them. This grant, which was recommended for the London colleges and Owens College, Manchester, by the Devonshire Commission in 1874, was increased to 25,000*l.* in 1897, in addition to a grant of 12,000*l.* to the three University Colleges of Wales. In 1904, a large and influential deputation urged upon Mr. Balfour, then Prime Minister, the need for further assistance to university education and research; and in announcing that the grant would at once be doubled, as well as redoubled in the following year, Mr. Balfour stated that the increase, which represented a capital sum of 3,000,000*l.* at 2½ per cent., was given as the result of the appeal made in 1903 by Sir Norman Lockyer in his presidential address to the British Association at Southport. Ten years later, in 1914, the Exchequer grants to universities and colleges in England and Wales amounted to 201,000*l.*: the stages of growth by which this sum has been reached are shown graphically in the diagram on p. 182.

It cannot be said, even now, that the funds at the disposal of our modern universities are sufficient to ensure the supply of advanced students and research workers demanded by the conditions of industrial development and the competition of other countries. There must be an increase in the number of scholarships from secondary schools to universities, and every inducement should be offered to promising students to train for research as a post-graduate study.

The Consultative Committee of the Board of Education, in a report on scholarships for higher education, published last year, estimated that the cost of the additional scholarships and other forms of endowment advised in the report would be about 340,000*l.* a year. It was recommended that the State provide, at an estimated annual cost of 67,500*l.*, about 250 scholarships for students from secondary schools who intend to pursue scientific or technical subjects at the universities, these scholarships to be awarded by the universities themselves, and to be renewable for a year or more after the conclusion of a degree course, upon the recommendation of a professor at the university, for the purposes of research in some branch of science or technology. An annual sum of 20,000*l.* was estimated to be required for these research scholarships.

The recommendations of the Consultative Committee have not yet been acted upon; but the scheme of the Committee of the Privy Council

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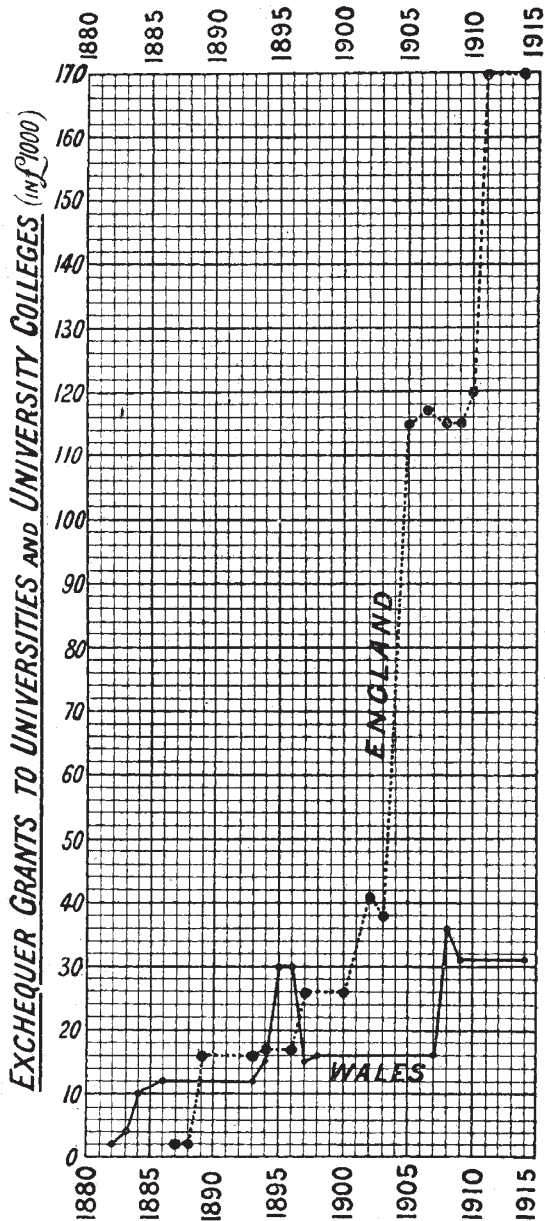
for Scientific and Industrial Research provides for the establishment and award of research studentships and fellowships, as well as for the undertaking of specific researches and the assistance of institutions, or departments of institutions, for the scientific study of problems affecting particular industries and trades. In the first

more than 14,524*l.* out of the 40,000*l.* placed at our disposal by Parliament for the financial year 1916-17." The committee recognises that a largely increased supply of competent researchers is necessary for the success of its work, and points out that the output of the universities is altogether insufficient to meet even a moderate expansion in the demand for research. It adds :—

"The annual number of students graduating with first- and second-class honours in science and technology (including mathematics) in the universities of England and Wales before the war was only about 530, and of these but a small proportion will have received any serious training in research. We have frequently found on inquiry that the number of workers of any scientific standing on a given subject of industrial importance is very limited. . . . The responsibility for dealing with the grave situation which we anticipate rests with the Education Departments of the United Kingdom. We shall be able to do something to encourage a longer period of training by the offer of research studentships and the like; but that will not suffice. It is useless to offer scholarships if competent candidates are not forthcoming, and they cannot be forthcoming in sufficient numbers until a larger number of well-educated students enter the universities. That is the problem which the Education Departments have to solve, and on the solution of which the success of the present movement, in our opinion, largely depends."

The report of the Consultative Committee already referred to suggests how the number of students might be increased by the State providing maintenance grants to enable selected scholars to continue their secondary education from the age of sixteen to that of eighteen or nineteen, by scholarships to universities from secondary schools and senior technical schools, and by the prolongation of scholarships for the purpose of training in research. Sir William Ramsay thought it preferable to subsidise teachers and teaching institutions with the object of increasing efficiency and reducing fees, rather than to add to the pecuniary resources of the student. His objection to the scholarship system was based chiefly on the method of award by competitive examination, by which it is impossible to estimate justly the capacity of candidates to deal with unfamiliar problems or ultimately to undertake research. This defect, however, may be obviated at the universities by placing the responsibility for the nomination for scholarships upon the professors under whom a student has been trained and making capacity for research a condition of award.

A considerable impetus to scientific study and training in research was given by the establishment of the now well-known science scholarships of the Royal Commissioners for the Exhibition of



report of this committee it was stated that grants had been recommended to an amount not exceeding 6000*l.* for about forty individual students and research workers, but the actual amount expended was only about 3550*l.* upon thirty-six workers; and the committee said in its second report: "Throughout our work has suffered in amount owing to the war, and we were unable to expend

1851. In 1889 the Commissioners announced their intention of appropriating from their accumulated funds an annual sum of not less than 500*l.* a year for the foundation of scholarships to enable the most promising students in selected colleges to continue their studies beyond the ordinary period of three years, provided that they show high promise for advancing science and its applications. The scholarships are awarded, not by examination, but upon the nomination of the institutions to which they were allotted, and their value is 150*l.* a year for two years, with possible extension to three years. The principle of selection was decidedly in advance of any scheme existing at the time, and the value of the scholarships is sufficient to encourage students of high capacity to devote time to research.

These scholarships are given for research only, and they are not allowed to be held at the institution where the scholar has graduated. It is acknowledged that nothing has done so much to promote free interchange among the universities of the Empire, and also with those of other countries, as the 1851 Exhibition Scholarships, and they might well form the nucleus of a great system of scholarships and fellowships expressly designed to promote that end. Since 1891 the Commissioners have appointed, on the nomination of universities throughout the Empire, in every year twenty research scholars. The number of workers thus subsidised has been small in comparison with the needs of the Empire; but it is universally admitted that the results have far more than justified the expenditure. The Consultative Committee, in its Report on Scholarships for Higher Education, notes, however, that in 1916 out of 305 scholars known to be at work, only seventy-nine were engaged in industry, as against 194 engaged in educational work and thirty-two in Government service. Moreover, of the seventy-nine engaged in industry, twelve had appointments in the United States, and seven more outside the British dominions.

The probable reason why two-thirds of these capable research students became teachers at the end of their scholarship periods is that suitable posts were not open to them in industrial works. This waste of capacity for original investigation will not be avoided unless manufacturers offer to trained researchers positions and prospects much more attractive than have been customary. Improvements have certainly been effected since the opening of the war, and the signs are favourable that the demand will increase when peace is restored. Meanwhile, the governing bodies of our universities and technical colleges should consider whether their resources will enable

original investigators on their staffs to be relieved of the necessity of preparing students for examination in order to train the most gifted of them in the methods of research. Unless this relief is given, and the first duty of the occupant of a scientific chair in an institution of university rank is recognised to be the promotion of research, the award of scholarships will be in vain, and the introduction of graduates into industry will not lead to the developments necessary to make our future position high and secure among the foremost nations of the world.

BRITISH ORNITHOLOGY.

- (1) *A Bibliography of British Ornithology from the Earliest Times to the End of 1912, including Biographical Accounts of the Principal Writers and Bibliographies of their Published Works.* By W. H. Mullens and H. Kirke Swann. Parts i.-vi. (London: Macmillan and Co., Ltd., 1916.) Price 6*s.* net each.
- (2) *British Birds.* Written and illustrated by A. Thorburn. In 4 vols. Vol. iv. Pp. vii+107+plates 61-80. (London: Longmans, Green, and Co., 1916.) Price, 4 vols., 6*l.* 6*s.* net.

(1) WITH the issue of the sixth part Messrs. Mullens and Swann bring to a conclusion their great "Bibliography of British Ornithology," forming a volume of more than 700 pages. This should, perhaps, be considered as only the first section of the whole work; for hopes are held out that it is to be followed by a geographical bibliography of the same subject, which will be another very laborious and most useful undertaking.

At the foot of their prefatory note the authors disarm criticism by very fittingly quoting from Dr. Samuel Johnson's preface to his Dictionary: "In this work, when it shall be found that much is omitted, let it not be forgotten that much likewise is performed." Much, indeed, has been performed in this monumental work, and as to omissions, some sixteen pages of addenda and corrigenda go far to supply any there may have been. This later matter has been printed on one side of the paper only for the convenience of those who wish to cut it up and insert in the proper places in the work.

We have already, when noticing the earlier parts, referred to the general plan of this work, to its far-reaching scope, and to its going back to the earliest days of anything in the shape of a study of our British birds. It goes back, indeed, to Bartholomæus Anglicus, who flourished about 1230-60, and whose "De Proprietatibus Rerum," in the translation printed by Wynkyn de Worde about 1495, is one of the earliest printed works on natural history in the English language. A feature of this final part is the remarkably full and able bibliography of the "Natural History of Selborne." The many